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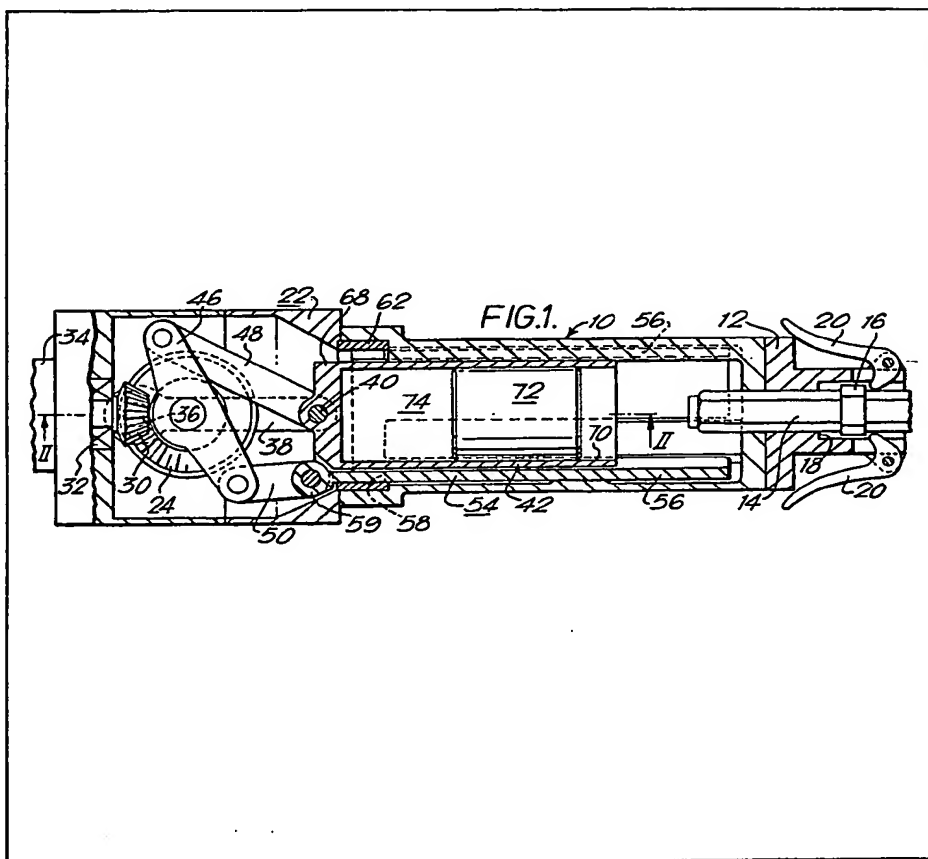
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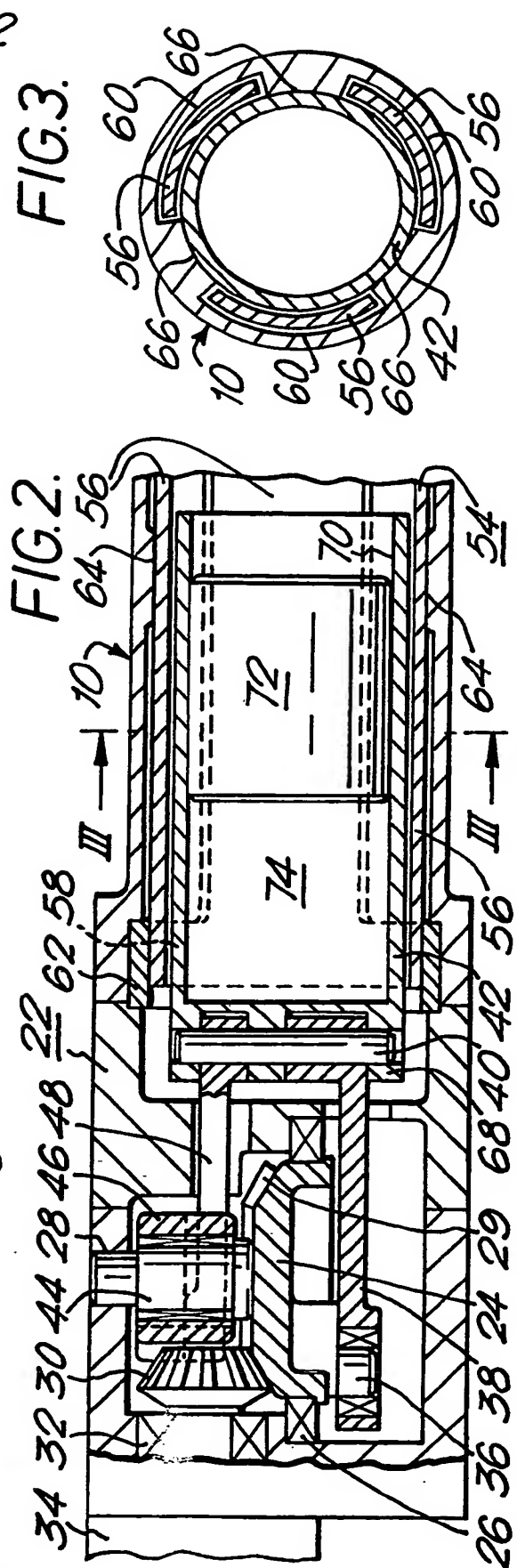
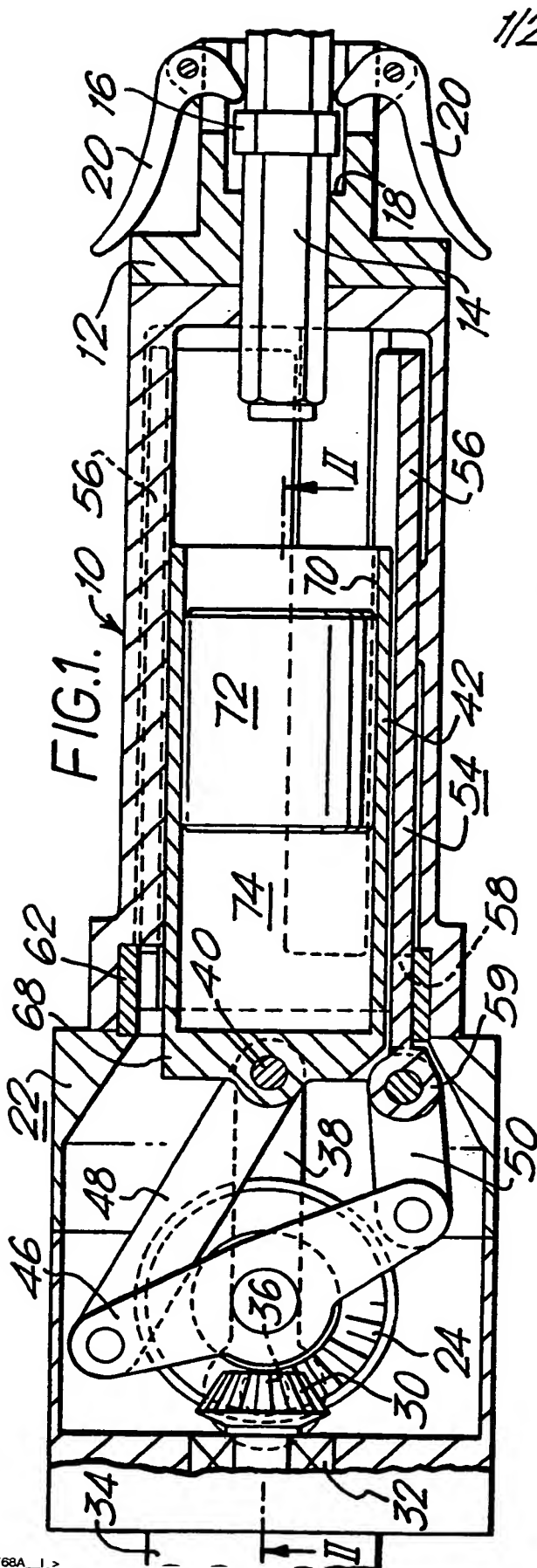
(54) Percussion apparatus

(57) Percussion apparatus, e.g. for a rammer, tamper, impact or breaker comprises, a hollow housing (10) having at one end a socket (12) for a tool blade, a motor (34) at the other end, and a cylinder (42) reciprocal in the housing (10) and containing a free piston (72) which impacts on the shaft (14) of a tool in the socket (12). The cylinder is driven by a rod (38) joined to the edge of a gear wheel (24) and to an end wall (68). Counterweight plates (56) travel in channels (60) formed in the wall of the housing (10), and are driven by a cranked lever (46) mounted centrally (44) on the wheel (24) one rod (48) joining one arm of the lever (46) to the cylinder (42) and another rod (48) joining the other arm to the counterweight (56).

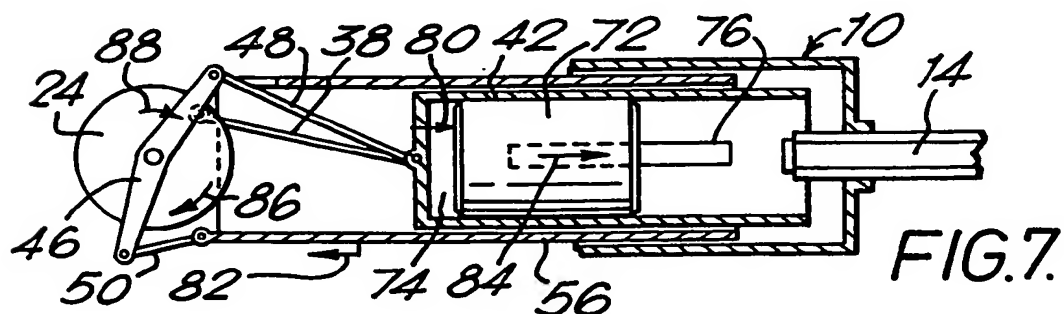
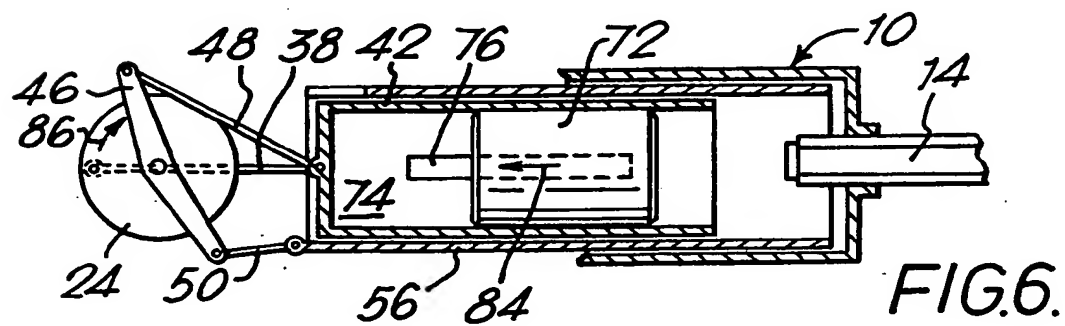
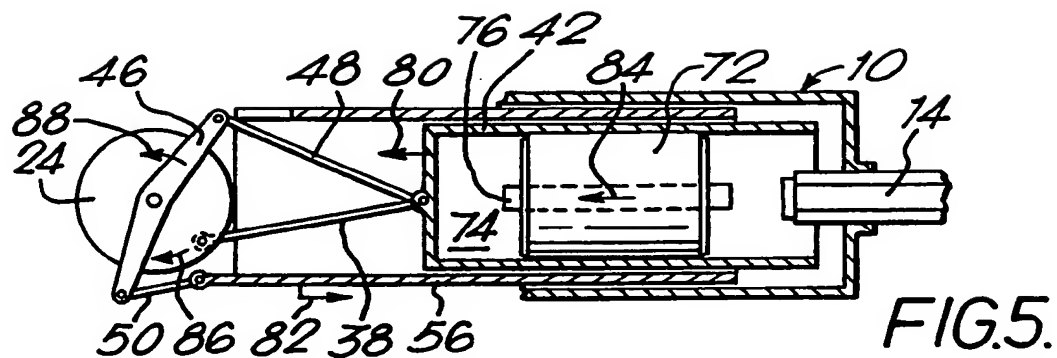
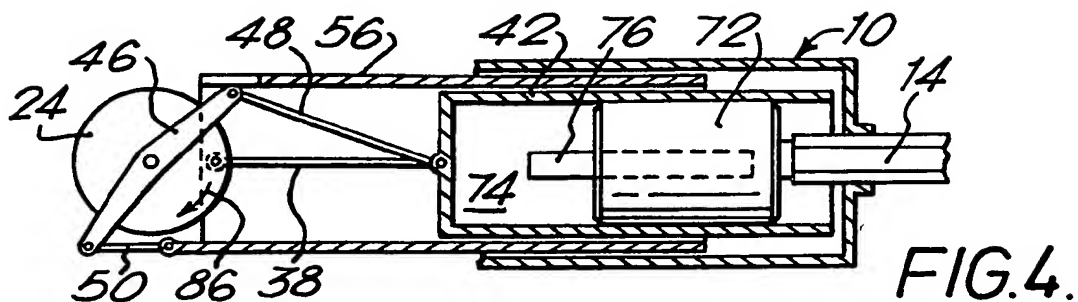


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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.



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SPECIFICATION

Percussion apparatus

- 5 The invention relates to percussion apparatus of the type used with a tool such as a rammer, tamper, impact, breaker, cutter, post driver, chisel, drill or the like.

According to the invention there is provided

- 10 percussion apparatus comprising a hollow housing having a socket to receive the shaft of a tool to be impacted, an impact piston arranged to travel within the housing towards and away from the tool shaft socket, and a counterweight disposed within the
15 housing and arranged to travel along a path generally parallel to that of the piston.

- Most preferably the impact piston is arranged to travel freely within a cylinder disposed within the housing, the cylinder being closed at its end remote
20 from the tool shaft socket, and the cylinder is arranged to travel towards and away from the tool shaft socket, and there is a relative time lag between the movement of the cylinder and the piston.

- The cylinder and the counterweight are preferably
25 driven by a motor. An advantage of the invention is that the motor may be drawn from a variety of types such as hydraulic, pneumatic, electric or internal combustion engine.

- Most preferably the motor includes a gear wheel
30 which is connected to the cylinder and the counterweight. Advantageously a connecting member joins the cylinder end wall and the wheel at a periphery of the wheel and a cranked arm is mounted on the gear wheel and arranged to pivot about the centre
35 thereof, and one arm portion is connected to the cylinder end wall and the other to the counterweight.

- Preferably the counterweight comprises a plurality of plates disposed generally parallel to the cylinder and the plates are arranged to travel in channels
40 formed in the wall of the housing.

The apparatus most preferably operates on pneumatic pressure alone, most advantageously air. The apparatus preferably includes handles by which it may be hand held.

- 45 In a particularly preferred embodiment, the percussion apparatus comprises an elongate hollow housing having at one end a socket to receive the shaft of a tool to be impacted, a motor located at the other end of the housing, an elongate cylinder being
50 disposed within the housing, a piston being freely movable within the cylinder, the end of the cylinder adjacent the motor being closed by an end wall and the inner wall of the cylinder having channels therein, a counterweight comprising a plurality of
55 counterweight plates disposed generally parallel to the cylinder and arranged to travel in channels formed in the wall of the housing, the motor including a gear wheel, a rod connecting the cylinder to the gear wheel at a periphery of the gear wheel
60 whereby rotation of the gear wheel causes reciprocation of the cylinder within the housing, a cranked lever pivotally mounted at the centre of the gear wheel, the lever having two opposite arms one of which is connected to the counterweight and the
65 other of which is connected to the cylinder whereby

pivotal movement of the lever causes reciprocation of the counterweight within the housing, movement of the cylinder towards the tool shaft socket causing movement of the piston away from that socket and causing compression of the air in the chamber defined by the end wall of the cylinder and the adjacent face of the piston, movement of the cylinder away from that socket causing decompression of that air so facilitating movement of the piston away from that socket, passage of the piston within the cylinder exposing the channel formations so facilitating decompression of that air, the pivotal movement of the lever causing the counterweight to move parallel to the cylinder in the opposite direction.

- 80 Apparatus according to the invention is particularly compact, most especially because the counterweight is within the housing wall and parallel to the cylinder.

- In order that the invention may be well understood, it will now be described by way of example only with reference to the accompanying diagrammatic drawings, in which

Figure 1 is a longitudinal sectional view of a part of a breaker unit,

- 90 *Figure 2* is a longitudinal sectional view taken on lines II-II of *Figure 1*,

Figure 3 is a transverse sectional view taken on lines III-III of *Figure 2*, and

- 95 *Figures 4 to 7* show successive stages of operation of the unit.

- The vibrator unit comprises a hollow housing 10 having a tool socket 12 at a forward end. The socket 12 receives the shaft 14 of a tool such as a rammer, tamper or impact or breaker tool, and the shaft 14
100 has a collar 16 dimensioned to abut a stop shoulder 18 in the socket 12. The tool shaft is held in the shaft by external latches 20. A gear housing 22 is connected to the rearward end of the housing 22. The edge toothing 29 of the wheel 24 meshes with a
105 bevel gear 30 in a bearing 32 and driven by a motor 34. The motor may be hydraulic, pneumatic, electric or internal combustion.

- The wheel 24 is joined by a cylinder rod 38 to a cylinder 42, to be described in detail later, by a pin 40
110 at the rear of the cylinder. A two arm pivotable cranked lever 46 is mounted on a central shaft 44 extending centrally above the wheel 24. One arm of the lever 46 is connected by a rod 48 to the pin 40 at the rear of the cylinder 42 and the other is connected
115 by a rod 50 to an end of a counterweight 54. The weight 54 comprises three arcuate plates 56 joined together at their rearward end by a ring 58 which is connected to the rod 50 on a pin 59. As shown in *Figure 3*, the three arcuate plates 56 travel in radially spaced apart channels 60 formed in the wall of the housing 10. The plates 56 are guided in their travel at the rearward end of the housing 10 by a guide ring 62 and along the channels 60 by guide surfaces 64.
120 Between the channels 60 are lands 66 which form a guide-path for the cylinder 42.

- At the forward end the cylinder 42 is open and at the rearward end the cylinder is closed by an end wall 68. An inner slave impact or ramming piston 72 travels freely along the inner surfaces 70 of the cylinder 42. A pneumatic pressure chamber 74 is
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defined between the inner surface of the end wall 68 and the facing wall of the inner piston 72. The inner surfaces 70 of the piston 42 are formed at predetermined locations with channels 76 arranged to allow the air in the chamber 74 to communicate with that air in the space on the opposite side of the inner piston 72. The location of the channels 76 is arranged to prevent transfer of air from the time when the cylinder 42 has reached its rearward limit to the time when the piston 72 has undergone about 60-70% of its forward movement. Because the cylinder rod 38 is connected to the periphery of the wheel 24 the cylinder 42 travels a sinusoidal path. Because the arms 48 of the lever 46 are pivotable about the centre of the wheel 24, the piston 72 reciprocates along rectilinear path but it does so after a time lag with respect to the movement of the cylinder 42 and this causes compression of the air in the pneumatic chamber 74. Thus as the cylinder 42 moves forward, i.e. to the right as seen in Figure 2, the ramming piston 72 moves to the left relative to the cylinder 42 so compressing the air in the chamber 74 until the compressed air causes the ramming piston 72 to travel forwards too. As the cylinder 42 is caused to reciprocate rearwardly, the air in the chamber 74 is decompressed and the reduced pressure eases the rearward travel of the ramming piston 72 under the rebound force after striking the end of the tool shaft 14. This is shown in Figures 4 to 7. In the condition of Figure 4, the cylinder 42 has reached its limit of forward travel, in Figure 6 the cylinder 42 has reached its limit of rearward travel, and Figure 5 shows an intermediate condition. As the ramming piston 72 moves from the condition of Figure 5 to that of Figure 6, the channels 76 are free to communicate with the air on each side of the ramming piston 72, and the air is drawn into the chamber 74. When the condition of Figure 7 is reached, the chamber 74 has its minimum volume and the highly compressed air urges the piston 72 to the forward position. In Figures 4 to 7, the arrow 80 shows the direction of movement of the cylinder 42, the arrow 82 shows the movement of the counter balance plates 56 and the arrow 84 shows the direction of movement of the ramming piston 72.

The unit described operates in a highly efficient way and is robust in field use, yet is of compact structure.

50 CLAIMS

1. Percussion apparatus comprising a hollow housing having a socket to receive the shaft of a tool to be impacted, an impact piston arranged to travel within the housing towards and away from the tool shaft socket, and a counterweight disposed within the housing and arranged to travel along a path generally parallel to that of the piston.
2. Apparatus according to Claim 1, in which the impact piston is arranged to travel freely within a cylinder disposed within the housing, the cylinder being closed at its end remote from the tool shaft socket.
3. Apparatus according to Claim 2, in which the cylinder is arranged to travel towards and away from

the tool shaft socket, and there is a relative time lag between the movement of the cylinder and the piston.

4. Apparatus according to any preceding Claim, in which the cylinder and the counterweight are both caused to travel along their respective paths by means of a motor.
5. Apparatus according to Claim 4, in which the motor is hydraulic, pneumatic, electric or an internal combustion motor.
6. Apparatus according to Claim 4 or 5, in which the motor includes a gear wheel and the cylinder and the counterweight are connected to the gear wheel.
7. Apparatus according to Claim 6, in which a connecting member joins the cylinder end wall and the wheel at a periphery of the wheel.
8. Apparatus according to Claim 6 or 7, in which a cranked arm is mounted on the gear wheel and arranged to pivot about the centre thereof, and one arm portion is connected to the cylinder end wall and the other to the counterweight.
9. Apparatus according to any preceding Claim, in which the counterweight comprises a plurality of plates disposed generally parallel to the cylinder.
10. Apparatus according to Claim 9, in which the plates are arranged to travel in channels formed in the wall of the housing.
11. Apparatus according to Claim 10, in which the lands between the channels are shaped to define a guide path for the cylinder.
12. Apparatus according to any preceding Claim, in which the inner wall of the cylinder includes at least one channel arranged to permit the medium in the chamber between the end wall of the cylinder and the adjacent face of the piston to communicate with the medium at the opposite face of the piston after the medium has been compressed.
13. Apparatus according to Claim 12, in which the medium is air.
14. Apparatus according to any preceding Claim, including handles for holding and using the apparatus.
15. Percussion apparatus comprising an elongate hollow housing having at one end a socket to receive the shaft of a tool to be impacted, a motor located at the other end of the housing, an elongate cylinder being disposed within the housing, a piston being freely movable within the cylinder, the end of the cylinder adjacent the motor being closed by an end wall and the inner wall of the cylinder having channels therein, a counterweight comprising a plurality of counterweight plates disposed generally parallel to the cylinder and arranged to travel formed in the wall of the housing, the motor including a gear wheel, a rod connecting the cylinder to the gear wheel at a periphery of the gear wheel whereby rotation of the gear wheel causes reciprocation of the cylinder within the housing, a cranked lever pivotally mounted at the centre of the gear wheel, the lever having two opposite arms one of which is connected to the counterweight and the other of which is connected to the cylinder whereby pivotal movement of the lever causes reciprocation of the counterweight within the housing, movement of the cylinder towards the tool shaft socket causing move-

ment of the piston away from that socket and causing compression of the air in the chamber defined by the end wall of the cylinder and the adjacent face of the piston, movement of the cylinder away from that socket causing decompression of that air so facilitating movement of the piston away from that socket, passage of the piston within the cylinder exposing the channel formations so facilitating decompression of that air, the pivotal movement of the lever causing the counterweight to move parallel to the cylinder in the opposite direction.

16. Percussion apparatus substantially as described and arranged to operate as shown in the accompanying drawings.

15 New claims filed on 23/9/80.
Superseded claims all.

New or amended claims:-

20 1. Percussion apparatus comprising a hollow housing having a socket to receive the shaft of a tool to be impacted, an impact piston arranged to travel within a cylinder in the housing towards and away from the tool shaft socket, a counterweight disposed within the housing and arranged to travel along a path generally parallel to that of the piston, a motor present to cause movement of the piston, the motor including a gear wheel, a cranked arm being mounted on the gear wheel and arranged to pivot about the centre thereof with one arm portion being connected to the cylinder end wall and the other to the counterweight.

25 2. Apparatus according to Claim 1, in which the impact piston is arranged to travel freely within the cylinder and the cylinder is closed at its end remote from the tool shaft socket.

30 3. Apparatus according to Claim 2, in which the cylinder is arranged to travel towards and away from the tool shaft socket, and there is a relative time lag between the movement of the cylinder and the piston.

4. Apparatus according to any preceding Claim in which the motor is hydraulic, pneumatic, electric or an internal combustion motor.

45 5. Apparatus according to any preceding claim in which a connecting member joins the cylinder end wall and the wheel at a periphery of the wheel.

6. Apparatus according to any preceding Claim, in which the counterweight comprises a plurality of plates disposed generally parallel to the cylinder.

50 7. Apparatus according to Claim 6, in which the plates are arranged to travel in channels formed in the wall of the housing.

8. Apparatus according to any preceding Claim in which the inner wall of the cylinder includes at least one channel arranged to permit the medium in the chamber between the end wall of the cylinder and the adjacent face of the piston to communicate with the medium at the opposite face of the piston after the medium has been compressed.

9. Apparatus according to Claim 12, in which the medium is air.

10. Apparatus according to any preceding Claim, including handles for holding and using the apparatus.

11. Percussion apparatus comprising an elongate hollow housing having at one end a socket to receive the shaft of a tool to be impacted, a motor located at the other end of the housing, an elongate cylinder being disposed within the housing, a piston being freely movable within the cylinder, the end of the cylinder adjacent the motor being closed by an end wall and the inner wall of the cylinder having channels therein, a counterweight comprising a plurality of counterweight plates disposed generally parallel to the cylinder and arranged to travel formed in the wall of the housing, the motor including a gear wheel, a rod connecting the cylinder to the gear wheel at a periphery of the gear wheel whereby rotation of the gear causes reciprocation of the cylinder within the housing, a cranked lever pivotally mounted at the centre of the gear wheel, the lever having two opposite arms one of which is connected to the counterweight and the other of which is connected to the cylinder whereby pivotal movement of the lever causes reciprocation of the counterweight within the housing, movement of the cylinder towards the tool shaft socket causing movement of the piston away from that socket and causing compression of the air in the chamber defined by the end wall of the cylinder and the adjacent face of the piston, movement of the cylinder away from that socket causing decompression of that air so facilitating movement of the piston away from that socket, passage of the piston within the cylinder exposing the channel formations so facilitating decompression of that air, the pivotal movement of the lever causing the counterweight to move parallel to the cylinder in the opposite direction.

12. Percussion apparatus substantially as described and arranged to operate as shown in the accompanying drawings.

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